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S&amp;H Form: PTO/

# UTILITY PATENT APPLICATION TRANSMITTAL

Attorney Docket No. 1317.1068/ MDS

First Named Inventor or Application Identifier:

Chong-Mok PARK

Express Mail Label No.

(Only for new nonprovisional applications under 37 CFR 1.53(b))

jc926 U.S. PTO

09/679069



10/05/00

**APPLICATION ELEMENTS**

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: **Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231**

1. ☒ Fee Transmittal Form
2. ☒ Specification, Claims & Abstract ..... [ Total Pages: 21 ]
3. ☒ Drawing(s) (35 USC 113) ..... [ Total Sheets: 7 ]
4. ☒ Oath or Declaration ..... [ Total Pages: 1 ]
  - a. ☒ Newly executed (original or copy)
  - b. ☐ Copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 17 completed)
    - i. ☐ **DELETION OF INVENTOR(S)**  
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation by Reference (usable if Box 4b is checked)  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Microfiche Computer Program (Appendix)
7. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
  - a. ☐ Computer Readable Copy
  - b. ☐ Paper Copy (identical to computer copy)
  - c. ☐ Statement verifying identity of above copies

**ACCOMPANYING APPLICATION PARTS**

8. ☒ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) [ ] Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. ☒ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. ☐ Small Entity Statement(s) [ ] Statement filed in prior application, status still proper and desired.
15. ☒ Certified Copy of Priority Document(s) (if foreign priority is claimed) (KPA 1999-43407)
16. ☐ Other:

**17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:**[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No:   /  **18. CORRESPONDENCE ADDRESS**

21171

PATENT TRADEMARK OFFICE

Staas &amp; Halsey

# NEW APPLICATION FEE TRANSMITTAL

Attorney Docket No. 1317.1068/ MDS

Application Number To be assigned

Filing Date October 5, 2000

AMOUNT ENCLOSED

\$

First Named Inventor

Chong-Mok PARK

## FEE CALCULATION (fees effective 12/29/99)

CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
TOTAL CLAIMS	32	- 20 =	12	X \$ 18.00 =	\$ 216.00
INDEPENDENT CLAIMS	10	- 3 =	7	X \$ 80.00 =	560.00
MULTIPLE DEPENDENT CLAIMS (any number; if applicable)				+ \$270.00 =	
<b>BASIC FILING FEE</b>					710.00
Total of above Calculations =				\$	1,486.00
Surcharge for late filing fee, Statement or Power of Attorney (\$130.00)					+
Reduction by 50% for filing by small entity (37 CFR 1.9, 1.27 & 1.28).					-
<b>TOTAL FILING FEE =</b>				\$	1,486.00
Surcharge for filing non-English language application (\$130.00; 37 CFR 1.52(d))					+
Recordation of Assignment (\$40.00; 37 CFR 1.21(h)(1))					40.00
<b>TOTAL FEES DUE =</b>				\$	1,526.00

## METHOD OF PAYMENT

- ☒ Check enclosed as payment.
- ☐ Charge "TOTAL FEES DUE" to the Deposit Account No., below.
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## GENERAL AUTHORIZATION

- ☒ If the above-noted "AMOUNT ENCLOSED" is not correct, the Commissioner is hereby authorized to credit any overpayment or charge any additional fees necessary to:

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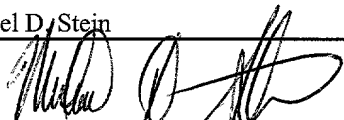
19-3935

Deposit Account Name

STAAS &amp; HALSEY LLP

- ☒ The Commissioner is also authorized to credit any overpayments or charge any additional fees required under 37 CFR 1.16 (filing fees) or 37 CFR 1.17 (processing fees) during the prosecution of this application, including any related application(s) claiming benefit hereof pursuant to 35 USC § 120 (e.g., continuations/divisionals/CIPs under 37 CFR 1.53(b) and/or continuations/divisionals/CPAs under 37 CFR 1.53(d)) to maintain pendency hereof or of any such related application.

SUBMITTED BY: STAAS &amp; HALSEY LLP

Typed Name	Michael D. Stein	Reg. No.	37,240
Signature		Date	October 5, 2000

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:

Chong-Mok PARK

Serial No.: To be assigned

Group Art Unit: Unassigned

Filed: October 5, 2000

Examiner: Unassigned

For: VIDEO STREAM PROCESSING METHOD FOR TIME-DELAYED  
VIEWING

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Before examination of the above-identified application, please amend the application as follows:

**IN THE ABSTRACT:**

Page 21,

line 2, change "which" to --which-- and then change "supports" to --supports--.

**REMARKS**

This Preliminary Amendment is submitted to correct typographical errors which appear in the specification as originally-filed.

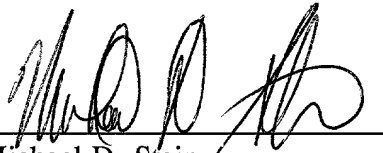
It is respectfully requested that this Preliminary Amendment be entered in the above-referenced application.

If any further fees are required in connection with the filing of this Preliminary Amendment, please charge same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

By:

  
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Date: October 5, 2000

## TITLE OF THE INVENTION

### VIDEO STREAM PROCESSING METHOD FOR TIME-DELAYED VIEWING

#### CROSS-REFERENCE TO RELATED APPLICATIONS

5           This application claims priority to an application entitled "Video Stream Processing Method for Time-Delayed Viewing" filed in the Korean Industrial Property Office on October 8, 1999 and assigned Serial No. 99-43407, the contents of which are hereby incorporated by reference.

#### BACKGROUND OF THE INVENTION

##### 10           1. Field of the Invention

          The present invention relates generally to a broadcast receiving system capable of concurrently supporting time-delayed viewing and recording/reproduction of a broadcast signal, and in particular, to a video stream processing method in which a circular buffer, assigned on a recording medium surface for time-delayed viewing, is constituted of discontinuous blocks.

##### 15           2. Description of the Related Art

          Due to its advantages of random access, high data transmission rate, low price, and large capacity as compared to other auxiliary storage devices, a hard disk drive (HDD), which is an auxiliary storage device of a computer system, is used as a random access storage device for a broadcast receiving system.

          Such a broadcast receiving system enables simultaneous recording/reproduction with time-delayed viewing of broadcast video streams by controlling buffering of the video streams input/output to/from the HDD.

          A description will hereinbelow be given of a method of arranging video streams on a hard disk recording area that is a recording medium in the broadcast receiving system.

10  
15  
20  
25

FIG. 1 illustrates a method of managing a hard disk as a circular buffer in a broadcast receiving system for time-delayed viewing. FIG. 2 illustrates a method of arranging a plurality of video streams discontinuously in the hard disk recording area.

Referring to FIG. 1, video streams are recorded in blocks of a fixed size when part of the hard disk recording area is managed in the form of a circular buffer. After a write point W and a read point R are designated, new video streams are recorded clockwise or counterclockwise from the write point W and a particular video stream is read by random access at an arbitrary time point in the circular buffer.

When video streams are discontinuously arranged as shown in FIG. 2, the hard disk recording area is divided into blocks of a fixed size and recorded video streams are stored in logical video file units, each logical video file occupying a plurality of blocks. In this case, the blocks of each video file are not always consecutive physically because discontinuous free blocks arise from deletion of video files of different sizes. Information associated with each video file (e.g., title and time) and information about the positions of blocks in the video file are recorded in a separate control information area 36. A video stream storing area 38 has video stream blocks arranged discontinuously. Pluralities of the video stream blocks form video files #1, #2.

The management of the hard disk area in the form of a circular buffer as shown in FIG. 1 incurs access time delay of a head since video streams are successively arranged. Consequently, two separate areas for time-delayed viewing of one channel and recording/reproduction of another channel should be alternately accessed when time-delayed viewing is implemented simultaneously with recording/reproduction.

A broadcast receiving system, if it employs the discontinuous video file arranging scheme shown in FIG. 2, can use the hard disk recording area flexibly and record video streams in files. However, the broadcast receiving system cannot implement continuous recording in a limited area as given in the circular buffer since free blocks are scattered. As a result, a time delay occurs in head movement.

## SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a video stream processing method in which circular buffer blocks are arranged discontinuously in such a way that time-delayed viewing of one channel can be implemented simultaneously with  
5 recording/reproduction of another channel.

Additional objects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

The time-delayed viewing mode is one in which the user can operate a recording and/or  
10 reproducing device so that the broadcast signal is recorded simultaneously within a temporary buffer (a buffer for holding the received content for a limited period of time, e.g., thirty minutes), while viewing prerecorded contents. The temporary buffer can later be retrieved for viewing prerecorded contents using rewind, pause and fast-forward operations. If the time-delayed viewing mode is inactive, no content will be recorded and only real-time viewing is possible.

The recording mode is activated when a user-scheduled event for recording a certain program channel at a certain period of time has met the recording start time. The reproducing mode is activated when a user-scheduled event for reproducing a recorded content (performed in the recording mode) has met the reproducing start time. The reproducing mode is useful for  
20 presenting the content to different terminals (TVs) for multi-user viewing or to VCRs for backup purposes. These modes are all independent from the time-delayed viewing, which operates on a temporary basis at a designated terminal. All of the different modes can be carried out simultaneously with different input/output devices, with all of the contents being stored in a shared disk storage system.

To achieve the above and other objects and advantages of the present invention, there is  
25 provided a video stream processing method in a broadcast receiving system for time-delayed viewing, which includes a hard disk drive having control information required for recording an input signal and reproducing recorded information recorded in a predetermined area. When a time-delayed viewing mode is selected, free blocks are sequentially assigned as discontinuous

circular buffer blocks in a disk recording area and video streams for time-delayed viewing are recorded in the assigned circular buffer blocks, based on the control information. When a recording mode is selected together with the time-delayed viewing mode, free blocks of the disk recording area are assigned, video streams of a channel to be recorded are recorded in the assigned free blocks, free blocks nearest to the recorded free blocks are assigned as circular buffer blocks, and video streams for time-delayed viewing are recorded in the assigned circular buffer blocks. When a reproduction mode is selected together with the time-delayed viewing mode, blocks to be reproduced are read based on the control information, free blocks nearest to the reproduced free blocks are assigned as circular buffer blocks, and video streams for time-delayed viewing are recorded in the assigned circular buffer blocks.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a method of managing a hard disk in the form of a circular buffer in a broadcast receiving system for time-delayed viewing;

FIG. 2 illustrates a method of arranging a plurality of video streams discontinuously in a hard disk recording area;

FIG. 3 is a block diagram of a broadcast receiving system capable of implementing time-delayed viewing simultaneously with recording/reproduction according to an embodiment of the present invention;

FIGS. 4A and 4B illustrate a layout of discontinuous circular buffer blocks in a hard disk recording area and a layout of recording area segments in a dual port RAM according to the embodiment of the present invention;

FIG. 5 is an exemplar view illustrating the structure of control information recorded in a control information area shown in FIG. 4;

FIG. 6 is a flowchart illustrating an initialization operation of the broadcast receiving system according to the embodiment of the present invention; and



FIG. 7 is a flowchart illustrating a video stream processing method according to the embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

FIG. 3 is a block diagram of a broadcast receiving system capable of simultaneously implementing time-delayed viewing and recording/reproduction of a broadcast signal according to an embodiment of the present invention. As previously noted, the time-delayed viewing mode, the reproducing mode, the recording mode are all independent from each other, wherein the reproducing mode is useful for presenting the contents to different terminals (TVs) remote-user viewing or to VCRs for backup purposes, or for still other purposes, and the time-delayed viewing mode operates on a temporary basis with a designated terminal. In this broadcast receiving system, all of the operations can be carried out simultaneously at different input/output devices, with all of the contents being stored in a shared disk storage system.

Referring to FIG. 3, a broadcast signal receiver 10 includes a first RF (Radio Frequency) tuner 12 for receiving an external digital broadcast signal, a plurality of second RF tuners 14 and 16 for receiving external analog broadcast signals, and a plurality of video compressors 18 and 20 for converting the analog signals received from the RF tuners 14 and 16 to digital signals and compressing the digital signals. A compressor 22 receives a video baseband signal which is simply compressed. The outputs of the compressors 18, 20 and 22 are supplied to a switching node 23, which provides its output to a dual port RAM 32 of a random access storage device 30.

The random access storage device 30 records a digital video stream received from the broadcast signal receiver 10 in a recording area of a hard disk under the control of a controller 40 and reads the stored video stream. This random access storage device 30 includes an HDD 34 and the dual port RAM 32. The HDD 34 comprises a plurality of hard disks for

permanently storing a digital video stream, a controller for controlling the operation of the HDD 34, and an expander (IEEE 1394 interface) for expanding the HDD 34. The dual port RAM 32 includes at least a video stream buffer for temporarily storing a digital video stream.

A video recoverer 50 recovers a video stream received from the random access storage device 30 through a system bus to an original signal and outputs the recovered video stream to a TV receiver 90.

The controller 40 has a ROM for storing control program data to control the random access storage device 30 and the broadcast signal receiver 10 and a RAM for temporarily storing data generated during a control operation.

A remote controller 60, having a plurality of control keys for system control, generates data corresponding to key input and outputs the data to the controller 40. The control keys include "pause", "rewind", "rapid search", and "time-delayed view".

A computer interface 70 interfaces signals between the broadcast receiving system according to the embodiment of the present invention and a computer. A timer 80 generates time information so that the broadcast receiving system can implement automatic recording.

FIGS. 4A and 4B illustrate a layout of blocks discontinuously arranged in a circular buffer area of a hard disk recording area and a layout of a recording area in the dual port RAM 32. The circular buffer area is formed on the HDD 34, and the storage area of the HDD 34 can be used to serve as a temporary storage buffer operated in a circulating mode. In this embodiment, a non-contiguous storage area is used for such a purpose. FIG. 5 is an exemplary view illustrating the structure of control information recorded in a control information area 36 shown in FIG. 4A.

Referring to the layout indicated in FIG. 4A, the hard disk recording area is divided into the control information area 36 and a video stream storing area 38 in which video stream blocks are arranged discontinuously. In the control information area 36 are recorded file attribute information (A), file assignment information (B), free block information for each track (or each cylinder) (C), and circular buffer block information (D) as shown in FIG. 5. File attribute information (A) provides the title, size, and recording time & date of a recorded video file. File assignment information (B) is information about the positions of blocks of each

file on a disk recording area. Free block information (C) for each track is used to manage information about the positions of free blocks in the disk recording area by tracks in order to rapidly assign a free block in a track under recording or reproduction when a recording/reproduction mode is implemented together with a time-delayed viewing mode.

5 Circular buffer block information (D) is used to manage the blocks of a current circular buffer.

The video stream storing area 38 comprises circular buffer areas a, b, and c, free blocks d, and blocks e in which video streams have been recorded in a mode other than a time-delayed viewing mode. The circular buffer areas a, b, and c do not always include successive blocks but may be arranged discontinuously in a disk area in a physical sense, while they are managed continuously in a logical sense. All blocks in the video stream storing area 38 are the same size. One block can include a plurality of consecutive sectors physically and is accessed by one disk operation (read/write) at one time.

Referring to the layout shown in FIG. 4B, the dual port RAM 32 is divided into a control information copy area (I) in which the control information is copied in system initialization, a circular buffer pointer area (II) having a pointer array that points to blocks of a circular buffer, and a video stream buffer area (III) for buffering video stream blocks. Write points and read points of the circular buffer have specific pointer values in the dual port RAM 32 so that the circular buffer areas may include discontinuous blocks.

A method of discontinuously arranging blocks in a circular buffer area will be described with reference to FIGs. 6 and 7.

In the embodiment of the present invention, free blocks are assigned for video streams in a disk recording area of the HDD 34 in an ascending order of tracks/sectors. Generally, tracks concentrically arranged on a disk are numbered from the outer-most circumference to the innermost circumference. After free blocks of the last track are assigned in this manner, the assignment restarts with the first track so that free blocks are assigned in the form of a circle. In case video streams of different channels are recorded concurrently, blocks are assigned interleavedly for each video stream to thereby minimize the movement of a head. Thus, the present broadcast receiving system can simultaneously record video streams of video

channels. For analog TV broadcasting, multiple receivers are used, whereas for digital TV broadcasting, a single multiplexed receiver will suffice.

FIG. 6 is a flowchart illustrating the initialization operation of the broadcast receiving system according to the embodiment of the present invention and FIG. 7 is a flowchart illustrating a video stream processing sub-routine according to the embodiment of the present invention.

Referring to FIG. 6, in order to initialize the broadcast receiving system upon system power-on, the controller 40 accesses control information recorded in the control information area 36 of the disk recording area and copies it in the control information copy area I of the dual port RAM 32 in step 100, changes circular buffer blocks to free blocks by updating the information of a circular buffer block pointed by a pointer at a write point with free block information in step 110, and initializes a circular buffer pointer in step 120.

Then, the controller 40 is placed in a standby mode and determines whether a video stream processing mode is set in step 130. The video stream processing mode refers to a mode for processing video streams received/transmitted through channels or video streams reproduced from a disk, including a time-delayed viewing mode, a recording mode, a reproduction mode, and a time-delayed viewing & recording/reproduction simultaneous mode. Therefore, if it is determined that a user has input a command to implement one of the modes in step 130, the controller 40 performs a video stream processing sub-routine in the way shown in FIG. 7 in step 140.

The video stream processing sub-routine will be described in detail with reference to FIG. 7. In FIG. 7, steps 230, 240, and 250 are implemented when the user has selected a time-delayed viewing mode only and steps 300 to 340, when the user has selected the time-delayed viewing mode and the recording mode at the same time. Steps 400 to 430 are for the case of selecting the time-delayed viewing mode and the reproduction mode simultaneously, steps 260 and 270 are commonly implemented for all modes, and step 440 is implemented in case the recording or reproduction mode only is selected.

If the controller 40 considers that the current system mode is set to a time-delayed viewing mode in step 200, it determines whether the time-delayed viewing mode is to be

implemented together with a recording or reproduction mode in steps 210 and 220 by checking user input of a command for a corresponding mode through the remote controller 60. If only the time-delayed viewing mode has been selected, the controller 40 assigns free blocks as circular buffer blocks referring to the control information in the control information copy area I of the dual port RAM 32 in step 230. The free blocks are assigned in a track/sector number ascending order as stated before. The term "circular buffer block" as used herein is defined as a free block assigned to form a circular buffer and record a video stream for time-delayed viewing therein.

In step 240, the controller 40 records digital video streams received from the broadcasting signal receiver 10 in the assigned circular buffer blocks. The controller 240 sets the pointer of the write point W to point to the last assigned circular buffer block in step 250 and changes the previously assigned circular buffer blocks to free blocks in step 260. The controller 240 updates the control information in the control information copy area I of the dual port RAM 32 and returns to the main loop shown in FIG. 6 in step 270. The updated information includes file attribute information (A), file assignment information (B), and free block information (C) for each block. More precisely, when the circular buffer block is assigned, the control information is updated in the main memory area, but the control information is not updated in the HDD file until requested by other operations which necessitates the same to be synchronized with the HDD 34 (i.e., when recording content within the recording mode). This is because the circular buffer is for temporary use and any block assigned to the circular buffer is free for use when the whole device is initiated (by power off/on). Unless the time-delayed viewing mode is released, the controller 40 repeatedly performs steps 230 to 270 so that video streams for time-delayed viewing are sequentially recorded in discontinuous circular buffer blocks in the hard disk recording area. It is to be noted here that discontinuous assignment of circular buffer blocks does not mean discontinuity of individual circular buffer blocks. In fact, if one track has a plurality of free blocks, all the free blocks may be assigned as circular buffer blocks. Consequently, discontinuous assignment of circular buffer blocks implies that all the circular buffer blocks are not arranged continuously.

Now there will be given a description of simultaneous implementation of time-delayed viewing and (reserved) recording/reproduction.

When a recording mode is selected during the time-delayed viewing mode or both modes are selected at the same time, the controller 40 assigns free blocks based on control information in step 300 and records video streams of a corresponding channel in the assigned free blocks in step 310. In step 320, the controller 40 assigns free blocks nearest to the recorded free blocks as circular buffer blocks. The controller 40 records video streams for time-delayed viewing in the assigned circular buffer blocks in step 330. The “free blocks nearest to the previous free blocks” may be on the same track or in the nearest track. This aims at minimization of track search time by minimizing head movement. If free blocks in an adjacent track are assigned, the track is preferably located in the head moving direction.

The controller 40 sets the pointer of the write point W to point the last assigned circular buffer block in step 340 and changes the previously assigned circular buffer blocks to free blocks in step 260. The controller 40 updates the control information in the control information copy area (I) of the dual port RAM 32 in step 270 and repeatedly performs steps 300 to 340 and steps 260 and 270 to concurrently implement the recording and time-delayed viewing modes until at least one of the time-delayed viewing mode and the recording mode is released. Accordingly, the nearest free blocks to free blocks selected for recording are assigned as circular buffer blocks so that the moving time of the head for track search can be reduced.

When a reproduction mode is selected during the time-delayed viewing mode or both modes are selected at the same time, the controller 40 reads blocks to be reproduced based on control information in step 400 and assigns free blocks nearest to the reproduced free blocks as circular buffer blocks in step 410 to minimize track search time through minimization of head movement. The controller 40 records video streams for time-delayed viewing in the assigned circular buffer blocks in step 420 and sets the pointer of the write point W to point the last assigned circular buffer block in step 430. The controller 40 changes the previously assigned circular buffer blocks to the free blocks in step 260, updates the control information in the control information copy area (I) of the dual port RAM 32 in step 270, and returns to the main

loop. Accordingly, the nearest free blocks to the free blocks read for reproduction are assigned as circular buffer blocks so that the moving time of the head for track search can be reduced. Meanwhile, if a command to release the current mode has been received from the user in the video stream processing mode, the controller 40 ends the control operation shown in FIG. 7. If a command to release the time-delayed viewing mode has been received from the user during concurrent implementation of the time-delayed viewing mode and the recording/reproduction mode, the controller records/reproduces video streams in a typical method like step 440.

In accordance with the present invention, head movement can be reduced by assigning circular buffer blocks for time-delayed viewing in a track near to video stream blocks that are being recorded/reproduced when a time-delayed viewing mode is performed simultaneously with a recording/reproduction mode.

While the invention has been shown and described with reference to a certain preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

## CLAIMS

What is claimed is:

- 1           1.       A video stream processing method in a broadcast receiving system for time-  
2 delayed viewing, which includes disks having control information required for recording an  
3 input signal and reproducing recorded information recorded and a drive for driving the disks,  
4 the video stream processing method comprising:  
5           sequentially assigning free blocks as discontinuous circular buffer blocks in a disk  
6 recording area, based on the control information when a time-delayed viewing mode is  
7 selected; and  
8           recording video streams for time-delayed viewing in the assigned circular buffer blocks.
- 1           2.       The video stream processing method of claim 1, further comprising updating the  
2 control information and setting a pointer of a write point to a last one of the assigned circular  
3 buffer blocks after the recording of the video streams.
- 1           3.       The video stream processing method of claim 1, wherein the sequentially  
2 assigning of the free blocks comprises assigning the free blocks as the circular buffer blocks in  
3 a track and sector number ascending order.
- 1           4.       The video stream processing method of claim 1, wherein the control information  
2 comprises file attribute information, file assignment information, free block information for  
3 each track, and circular buffer block information.
- 1           5.       The video stream processing method of claim 1, further comprising:  
            recovering the circular buffer blocks to the free blocks when the broadcast receiving  
system is initialized.



1           6.     The video stream processing method of claim 1, further comprising recovering  
2 the assigned circular buffer blocks to the free blocks and updating the control information  
3 when a next circular buffer block is assigned.

1           7.     The video stream processing method of claim 1, wherein the sequentially  
2 assigning free blocks comprises interleavedly assigning the free blocks for each video stream,  
3 if the video streams are of different channels to be recorded concurrently.

1           8.     The video stream processing method of claim 5, wherein the recovering of the  
2 circular blocks comprises updating information of one of the circular buffer blocks which is  
3 pointed by a pointer at a write point with free block information, the video stream processing  
4 method further comprising initializing the pointer.

1           9.     A video stream processing method in a broadcast receiving system for time-  
2 delayed viewing, which includes a hard disk drive having control information required for  
3 recording an input signal and reproducing recorded information recorded in a predetermined  
4 area, the video stream processing method comprising:

5                 sequentially assigning free blocks as discontinuous circular buffer blocks in a  
6 disk recording area and recording video streams for time-delayed viewing in the assigned  
7 circular buffer blocks, based on the control information when a time-delayed viewing mode is  
8 selected; and

9                 assigning free blocks of the disk recording area and recording video streams of a  
10 channel to be recorded in the assigned free blocks when a recording mode is selected during  
11 the time-delayed viewing mode, assigning free blocks nearest to the recorded free blocks as the  
12 circular buffer blocks, and recording the video streams for time-delayed viewing in the  
13 assigned circular buffer blocks.

1           10.     The video stream processing method of claim 7, further comprising updating the  
2 control information and setting a pointer of a write point to a last one of the assigned circular  
3 buffer block each time the video streams are recorded in the free blocks subsequent to the  
4 recording of the video streams for time-delayed viewing in the assigned circular buffer blocks.

1           11.     The video stream processing method of claim 9, wherein the free blocks nearest  
2 to the recorded free blocks are in a same track or a nearest track of the recorded free blocks.

1           12.     A video stream processing method in a broadcast receiving system for time-  
2 delayed viewing, which includes a hard disk drive having control information required for  
3 recording an input signal and reproducing recorded information recorded in a predetermined  
4 area, the video stream processing method comprising:

5                 sequentially assigning free blocks as discontinuous circular buffer blocks in a disk  
6 recording area and recording video streams for time-delayed viewing in the assigned circular  
7 buffer blocks, based on the control information when a time-delayed viewing mode is selected;

8                 assigning free blocks of the disk recording area, recording video streams of a channel  
9 to be recorded in the assigned free blocks, assigning free blocks nearest to the recorded free  
10 blocks as the circular buffer blocks, and recording video streams for time-delayed viewing in  
11 the assigned circular buffer blocks, when a recording mode is selected together with the time-  
12 delayed viewing mode; and

13                reading free blocks to be reproduced based on the control information, assigning free  
14 blocks nearest to the reproduced free blocks as the circular buffer blocks, and recording the  
15 video streams for time-delayed viewing in the assigned circular buffer blocks, when a  
16 reproduction mode is selected together with the time-delayed viewing mode.

1           13.     The video stream processing method of claim 12, wherein the free blocks  
2 nearest to the recorded free blocks are in a same track or a nearest track of the recorded free  
3 blocks.

1           14.    A video stream processing method in a broadcast receiving system for time-  
2 delayed viewing, which includes a hard disk drive having control information required for  
3 recording an input signal and reproducing recorded information in a predetermined area, the  
4 video stream processing method comprising:

5                sequentially assigning free blocks as discontinuous circular buffer blocks in a disk  
6 recording area and recording video streams for time-delayed viewing in the assigned circular  
7 buffer blocks, based on the control information when a time-delayed viewing mode is selected;  
8 and

9                reading blocks to be reproduced based on the control information, assigning free blocks  
10 nearest to the reproduced free blocks as the circular buffer blocks, and recording the video  
11 streams for time-delayed viewing in the assigned circular buffer blocks, when a reproduction  
12 mode is selected together with the time-delayed viewing mode.

1           15.    A video stream processing method in a broadcast receiving system for time-  
2 delayed viewing, which includes a hard disk drive having control information required for  
3 recording an input signal and reproducing recorded information in a predetermined area, the  
4 video stream processing method comprising:

5                assigning free blocks of a recording disk area;  
6                recording video streams of a channel to be recorded in the assigned free blocks;  
7                assigning free blocks nearest to the recorded free blocks as circular buffer blocks; and  
8                recording the video streams for time-delayed viewing in the assigned circular buffer  
9 blocks.

1           16.    A video stream processing method in a broadcast receiving system for time-  
2 delayed viewing, which includes a hard disk drive having control information required for  
3 recording an input signal and reproducing recorded information in a predetermined area, the  
4 video stream processing method comprising:

5                reading blocks to be reproduced based on the control information;

6 assigning free blocks nearest to the reproduced free blocks as circular buffer blocks;  
7 and  
8 recording video streams for time-delayed viewing in the assigned circular buffer blocks.

1 17. A video stream processing method in a broadcast receiving system, the video  
2 stream processing method comprising:  
3 recording a video stream in free blocks of a disk recording area or reading a recorded  
4 video stream recorded in the disk recording area; and  
5 assigning free blocks nearest to the recorded or reproduced free blocks as circular  
6 buffer blocks.

1 18. A recording medium in a broadcast receiving system having a hard disk drive,  
2 the recording medium comprising:  
3 a video stream storing area which records video streams, wherein the video stream  
4 storing area comprises video stream blocks which are arranged discontinuously; and  
5 a control information area which stores control information relating to the video stream  
6 storing area.

1 19. The recording medium of claim 18, wherein the video stream storing area  
2 comprises:  
3 circular buffer blocks which are discontinuously arranged, and which record ones of the  
4 video streams for time-delayed viewing; and  
5 free blocks which are assignable to be designated as the circular buffer areas, or which  
6 record other ones of the video streams during a mode other than a time-delayed viewing mode.

1 20. The recording medium of claim 18, wherein the control information area  
2 comprises:  
3 file attribute information;  
4 file assignment information;

5 free block information which manage the free blocks for each track of the recording  
6 medium; and  
7 circular block information which manage the circular buffer blocks.

1 21. A broadcast receiving system, comprising:  
2 a hard disk drive having a hard disk as a recording medium, the recording medium  
3 having control information for recording an input signal and reproducing recorded information;  
4 and  
5 a controller which sequentially assigns free blocks as discontinuous circular buffer  
6 blocks on the recording medium, based upon the control information in response to a time-  
7 delayed viewing mode being selected, and which records video streams for time-delayed  
8 viewing in the assigned circular buffer blocks.

9 22. The broadcast receiving system of claim 21, further comprising:  
10 a broadcast signal receiver comprising:  
11 a first radio frequency tuner which receives an external broadcast signal,  
12 a second radio frequency tuner which receives an external analog broadcast  
13 signal,  
14 a video compressor which converts the received analog signal to a digital signal  
and compresses the digital signal, and  
a selector which selectively enables transmission of the external digital broadcast  
signal and the compressed digital signal;  
a random access memory which temporarily stores the selectively transmitted external  
digital broadcast signal and the compressed digital signal from the selector prior to recording  
on and subsequent to reading from the recording medium; and  
a video recovery unit which restores the video streams read from the recording medium  
and temporarily stored in the random access memory to original signals.

1           23.    The broadcast receiving system of claim 21, further comprising:  
2           an input device which enables simultaneous operation of the time-delayed viewing mode  
3           and a recording mode;

4           wherein the controller assigns free blocks of the recording medium, records the video  
5           streams of a channel to be recorded in the assigned free blocks in response to the selection of  
6           the simultaneous operation of the time-delayed and recording modes, assigns free blocks  
7           nearest to the recorded free blocks as circular buffer blocks, and records the video streams for  
8           time-delayed viewing in the assigned circular buffer blocks.

1           24.    The broadcast receiving system of claim 21, further comprising:  
2           an input device which enables simultaneous selection of the time-delayed viewing mode  
3           and a reproduction mode;

4           wherein the controller reads blocks to be reproduced based on the control information,  
5           assigns free blocks nearest to the reproduced free blocks as the circular buffer blocks, and  
6           records the video streams for time-delayed viewing in the assigned circular buffer blocks, in  
7           response to the selection of the simultaneous operation of the time-delayed and reproduction  
8           modes.

1           25.    The broadcast receiving system of claim 21, wherein the controller updates the  
2           control information and sets a pointer of a write point to a last one of the assigned circular  
3           buffer blocks after recording the video streams.

1           26.    The broadcast receiving system of claim 21, wherein the hard disk drive  
2           comprises:

3           a control unit which controls the hard disk drive;  
4           and an expander which expands the hard disk drive.

5           27.    The broadcast receiving system of claim 22, wherein the controller comprises:  
6           a read-only memory which stores control program data to control the random access  
7 memory and the hard disk drive; and  
8           a second random access memory which temporarily stores data during a control  
9 operation of the controller.

10          28.    The broadcast receiving system of claim 21, further comprising:  
11          a random access memory which temporarily stores the video streams prior to recording  
12 on and subsequent to reading from the recording medium, wherein the random access memory  
13 comprises:  
14          a control information copy area in which the control information is copied during  
15 system initialization of the broadcast receiving system,  
16          a circular buffer pointer area having a pointer array which points to the circular buffer  
17 blocks, and  
18          a video stream buffer area which buffers blocks of the video streams; and  
19          a video recovery unit which restores the video streams read from the recording  
20 medium and temporarily stored in the random access memory to original signals.

21          29.    The broadcast receiving system of claim 28, wherein the circular buffer blocks  
22 form a circular buffer and write and read pointers of the circular buffer have specific pointer  
23 values in the random access memory so that the circular buffer blocks of the circular buffer are  
24 discontinuous.

25          30.    The broadcast receiving system of claim 21, wherein the controller sets a  
26 pointer of a write pointer to a last one of the assigned circular buffer blocks and changes the  
27 assigned circular buffer blocks to free blocks subsequent to recording the video streams for  
28 time-delayed viewing in the assigned circular buffer blocks.

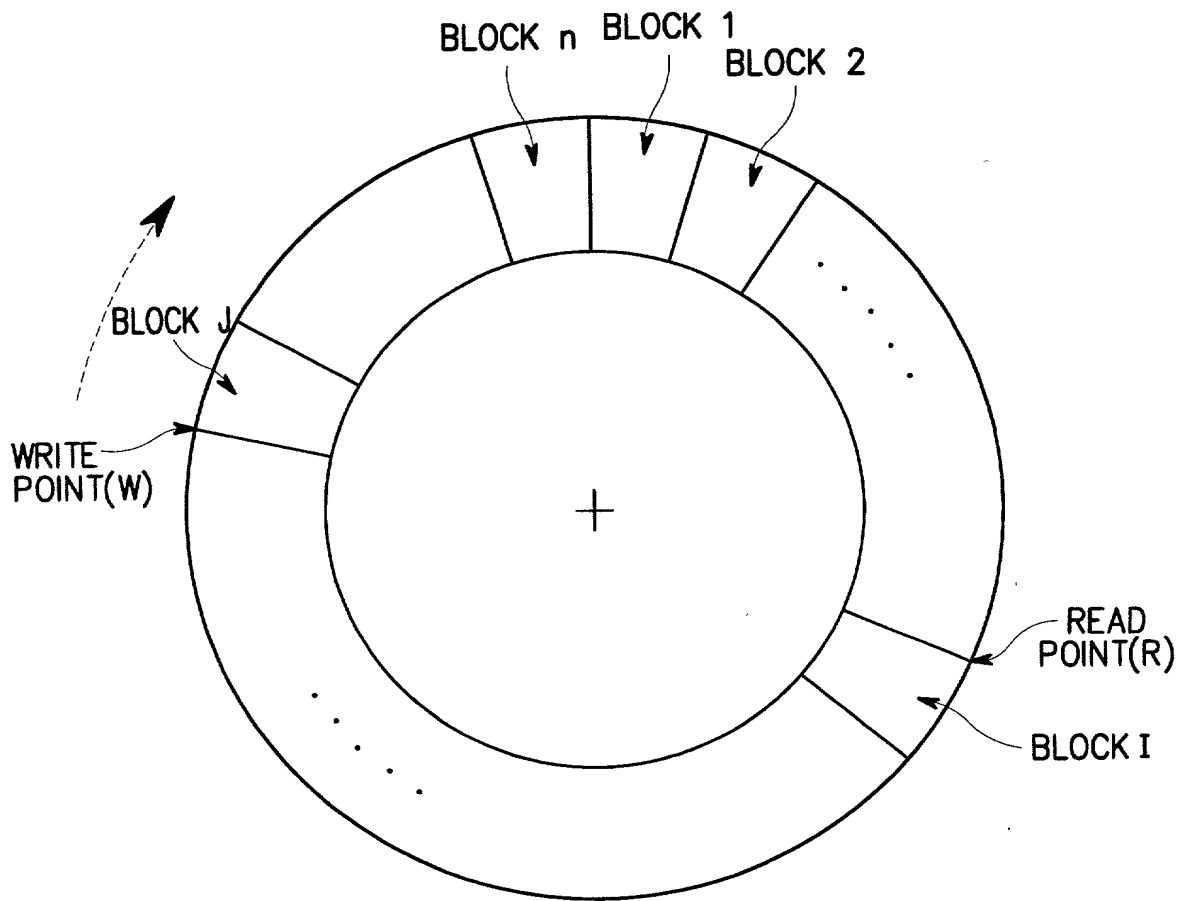
31. The broadcast receiving system of claim 28, wherein the controller sets a pointer of a write pointer to a last one of the assigned circular buffer blocks, changes the assigned circular buffer blocks to free blocks, and updates the control information in the control information copy area of the random access memory, subsequent to recording the video streams for time-delayed viewing in the assigned circular buffer blocks.

32. A broadcast receiving system, comprising:  
a hard disk drive having a hard disk as a recording medium, the recording medium having control information for recording an input signal and reproducing recorded information;  
a controller which records a video stream in free blocks of the recording medium or reading a recorded video stream recorded on the recording medium; and  
assigning free blocks nearest to the recorded or reproduced free blocks as circular buffer blocks.



## ABSTRACT OF THE DISCLOSURE

A broadcast receiving system which simultaneously supports time-delayed viewing and recording/reproduction. In the broadcast receiving system, blocks are discontinuously arranged in a circular buffer to rapidly implement time-delayed viewing of a channel and recording/reproduction of another channel at the same time. To do so, circular buffer blocks are discontinuously arranged on a disk surface in a time-delayed viewing mode. If the time-delayed viewing mode is performed simultaneously with a recording/reproduction mode, video streams for time-delayed viewing are recorded in free blocks nearest to blocks in which video streams of a channel to be recorded are recorded or from which video streams of a channel to be reproduced are reproduced. Therefore, two or more modes can be performed effectively and simultaneously.

**FIG. 1****PRIOR ART**

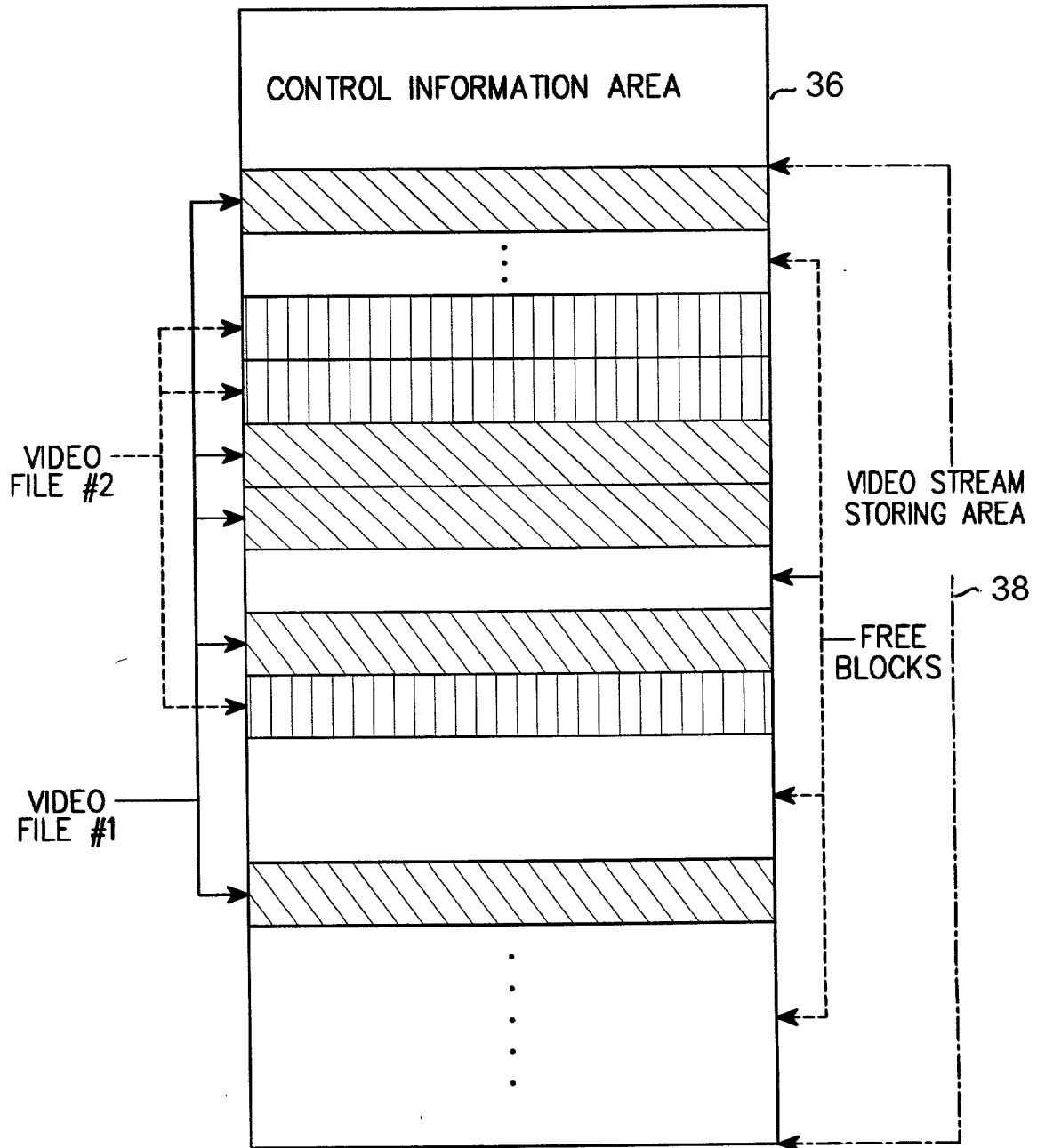
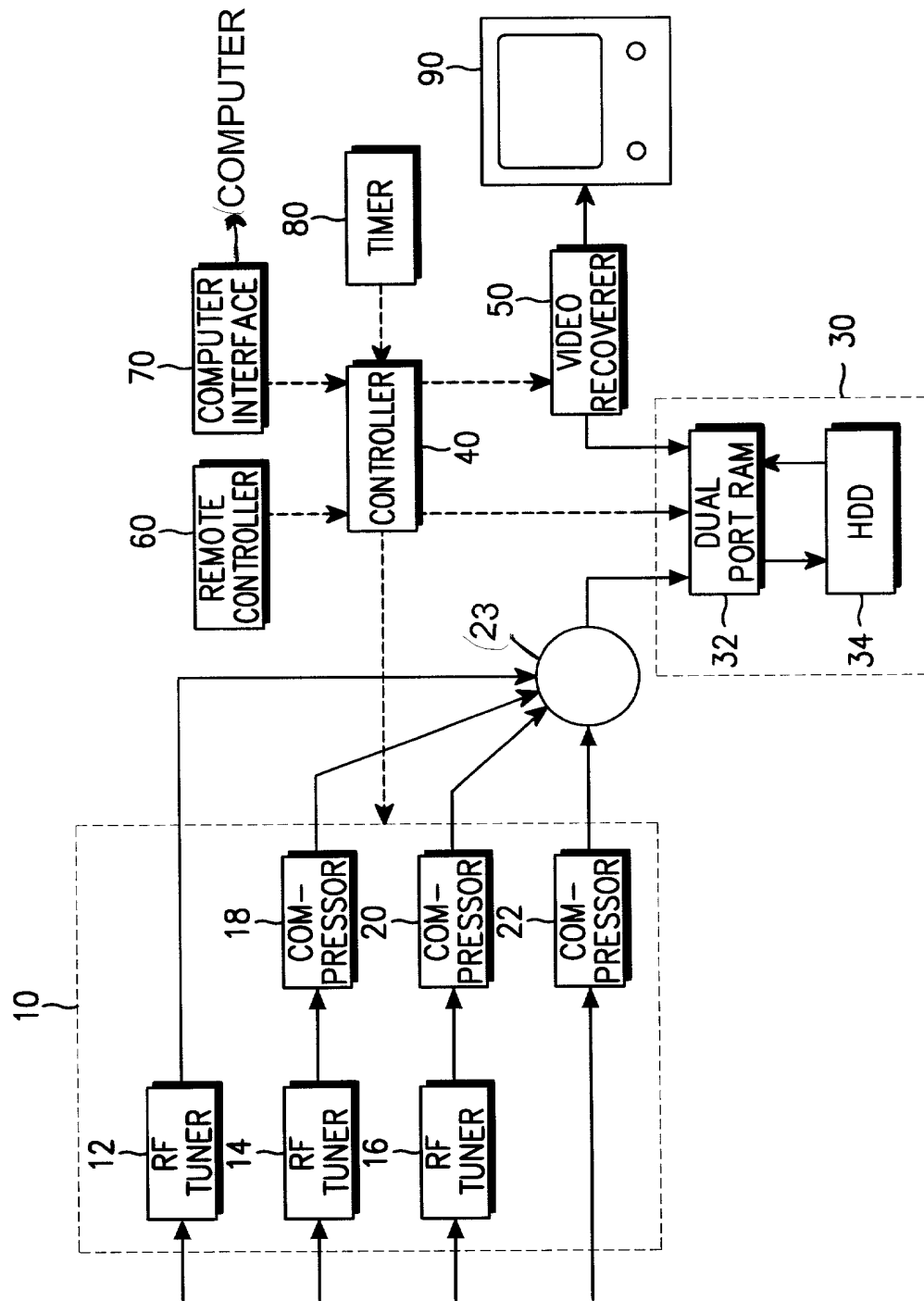
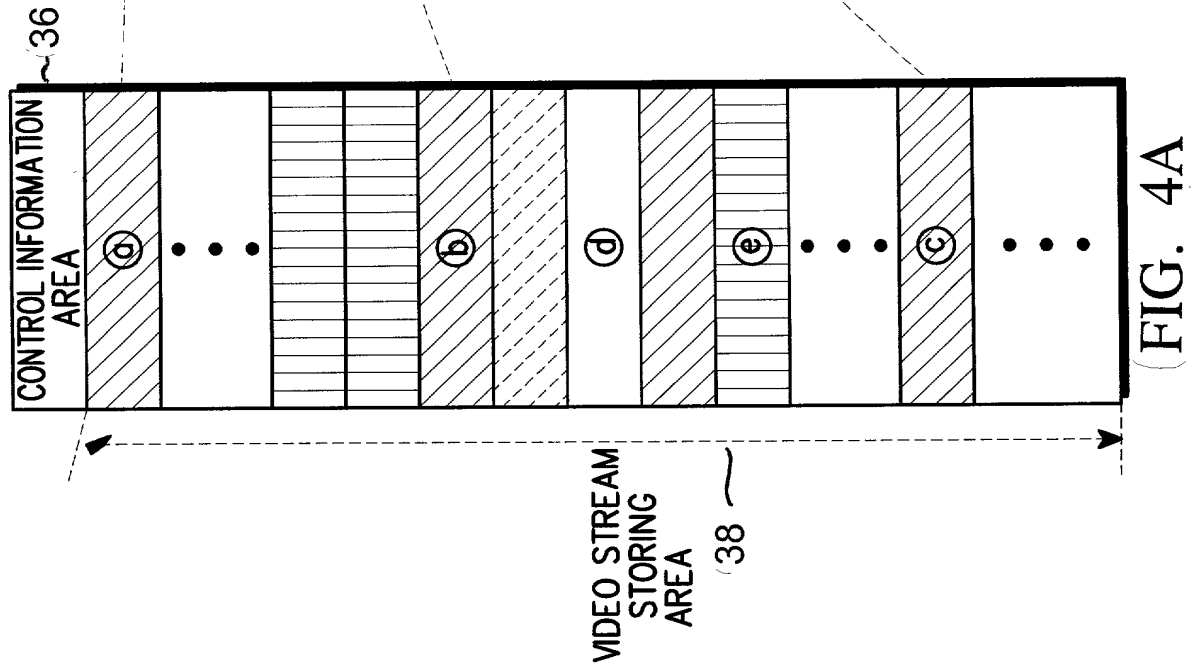


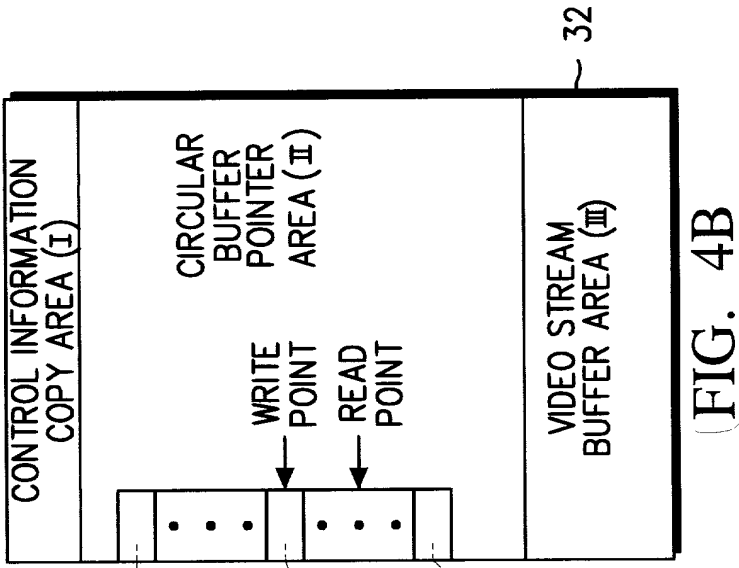
FIG. 2 PRIOR ART

FIG. 3





(FIG. 4A)



(FIG. 4B)

FILE ATTRIBUTE INFORMATION (A)
FILE ASSIGNMENT INFORMATION (B)
FREE BLOCK INFORMATION FOR EACH TRACK (C)
CIRCULAR BUFFER BLOCK INFORMATION(D)

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FIG. 5

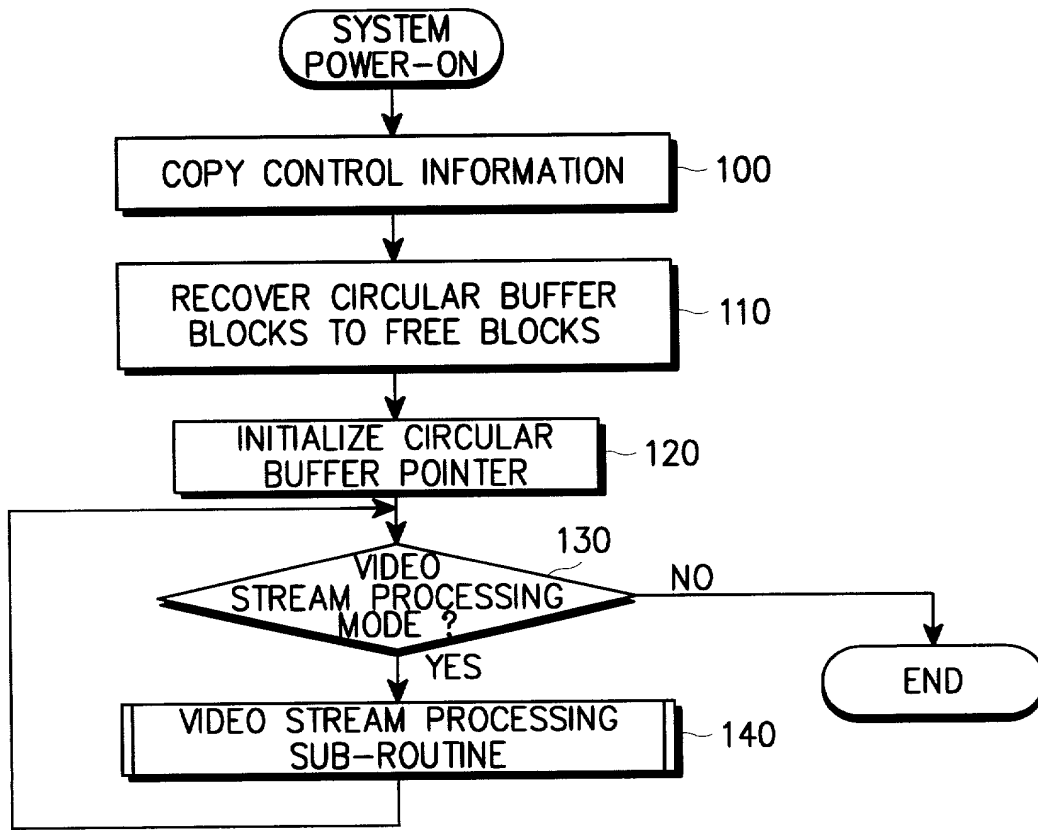
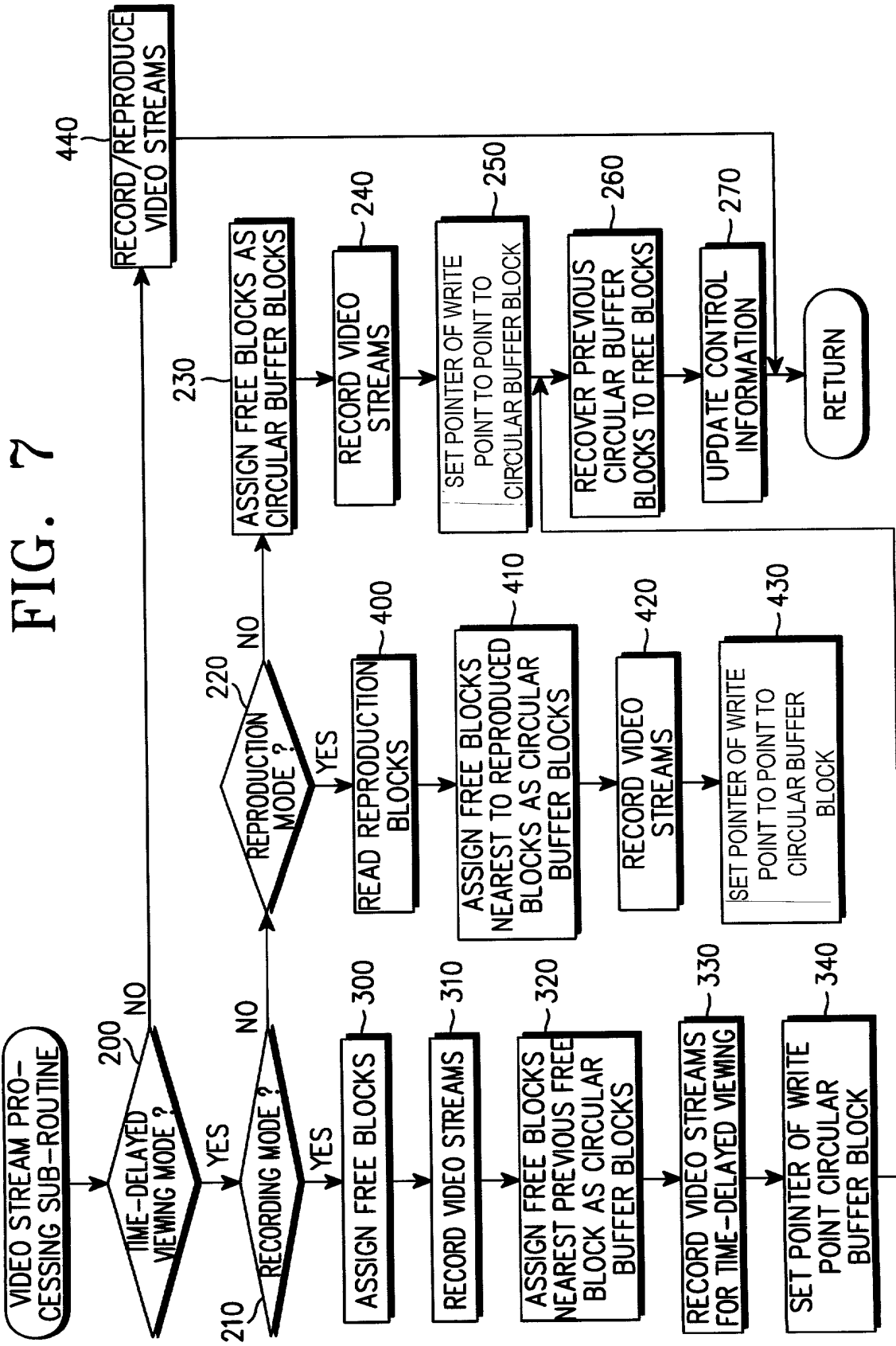


FIG. 6





## COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

## VIDEO STREAM PROCESSING METHOD FOR TIME-DELAYED VIEWING

the specification of which is attached hereto unless the box is checked:

☐ was filed on \_\_\_\_\_ as United States Application Number or PCT International Application

Number \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefit(s) under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

1999-43407 Republic of Korea 08/10/1999  
(Number) (Country) Day/Month/Year Filed

☐

\_\_\_\_\_  
(Number) (Country) Day/Month/Year Filed

☐

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Serial No.) (Filing Date) (Status -- patented, pending, abandoned)

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I hereby appoint the following attorneys and agent to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Second Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence \_\_\_\_\_ Citizenship \_\_\_\_\_

Post Office Address \_\_\_\_\_

☐ Additional inventors are being named on separately numbered sheets attached hereto.